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# OSCILLOGRAPH-RECORD CAMERAS

## TYPES 298, 299 & 302

TYPE WE HAVE

**Allen B. Du Mont Laboratories, Inc.**

TECHNICAL PRODUCTS DIVISION

760 BLOOMFIELD AVENUE, CLIFTON, N. J., U. S. A.

DUMONT

# OSCILLOGRAPH-RECORD CAMERAS

## TYPES 298, 299 & 302

Allen B. DuMont Laboratories, Inc.

TECHNICAL PRODUCTS DIVISION

760 BLOOMFIELD AVENUE, CLIFTON, N. J., U. S. A.

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ALLEN B. DU MONT LABORATORIES, INC.
TECHNICAL PRODUCTS DIVISION
Clifton, N. J.
U. S. A.

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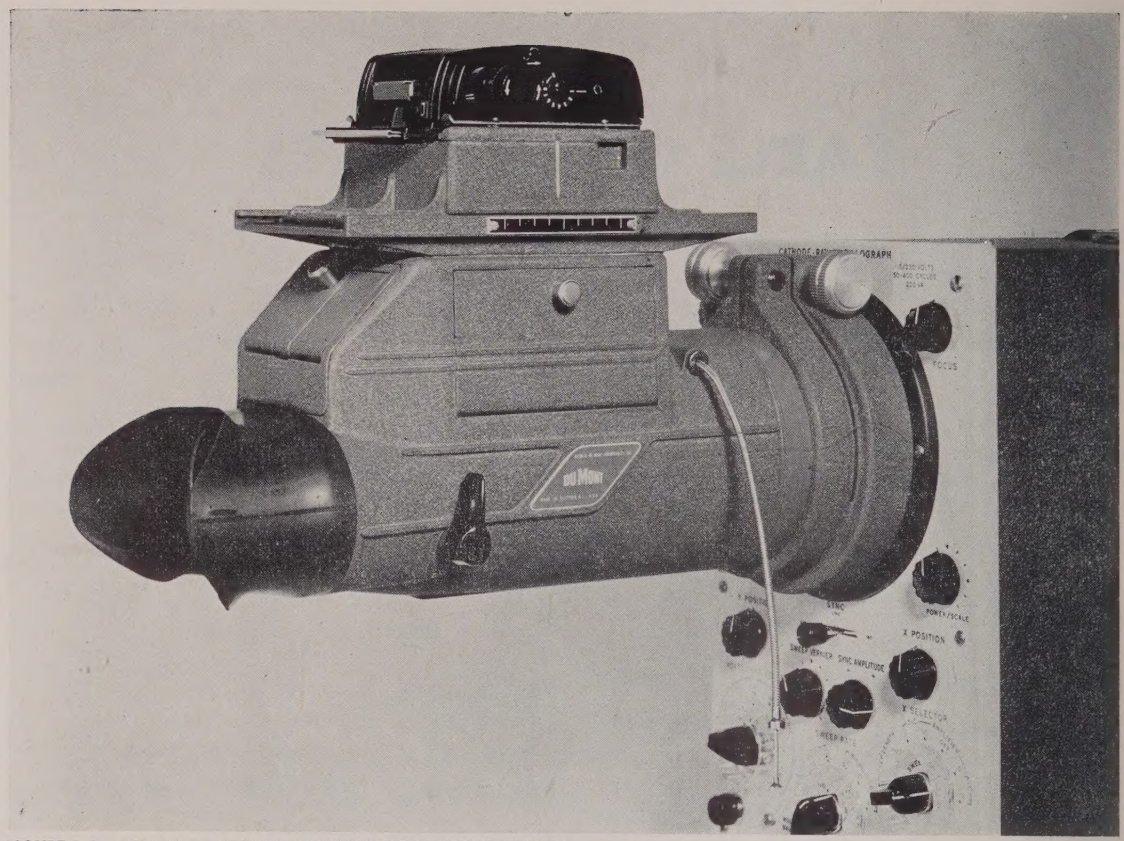
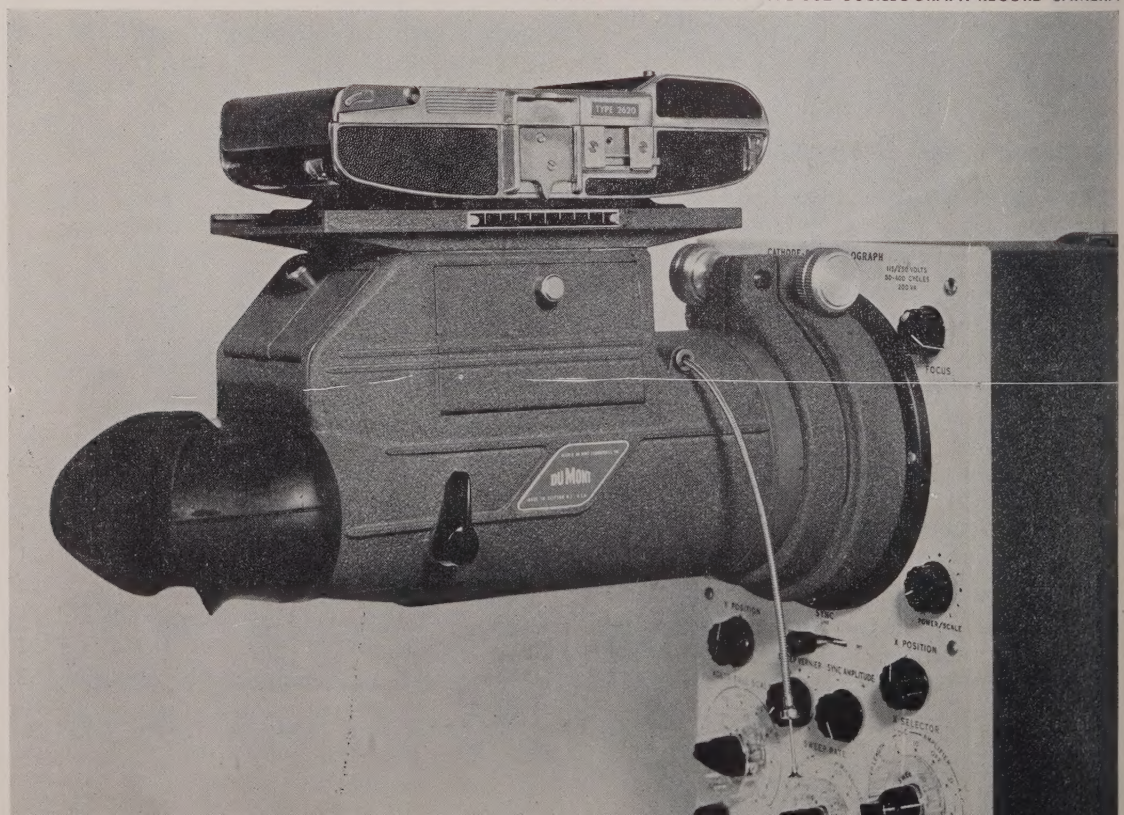



FIGURE 1-1. DU MONT TYPE 299 OSCILLOGRAPH-RECORD CAMERA

FIGURE 1-2. DU MONT TYPE 302 OSCILLOGRAPH-RECORD CAMERA



# SECTION 1
# GENERAL DESCRIPTION

### 1-1. PURPOSE

The Du Mont Types 298, 299, and 302 (see Figures 1-1 and 1-2) are specially designed Oscillograph-record Cameras used for photographing cathode-ray tube phenomena where single-frame recordings of stationary patterns or single-transients are required.

### 1-2. FEATURES

The Du Mont Type 298 camera is equipped with a special f/1.5 lens, enabling recording of very high writing rates (up to 200 inches per microsecond with E. K. Super XX Film) and uses a Graflex roll film holder with No. 120 film.

The Du Mont Type 299 camera is supplied with either a f/1.9 or a f/2.8 lens (depending on order) enabling recording of reasonable speed writing rates. (See Table 1-1.). This camera also uses the Graflex film holder.

The Du Mont Type 302 camera is also supplied with either the f/1.9 or the f/2.8 lens (depending on order) but utilizes the "Polaroid Land Model 95 Camera Back" enabling pictures to be made in one minute and eliminates processing time in the dark room.

All three camera types use a similar layout of components including housings, a beam-splitter mirror, lens, and shutter assembly. A rubber eye-shield is provided for binocular viewing minimizing visual parallax. The common housing design incorporates a mounting plate, sliding adapter, and a camera back. The Types 298 and 302 are interconvertible; this versatility provides the user with a number of possibilities in oscillographic recording. Provision is made for recording data in the camera housing. Two miniature lamps, a dry cell, a data-recording surface and a push-button switch are provided to facilitate recording. Data may be recorded simultaneously with an oscillogram.

### 1-3. TECHNICAL SUMMARY

Table 1-1 lists the essential characteristics of the Types 298, 299, and 302.

## TABLE 1-1.
## TECHNICAL SUMMARY

| CHARACTERISTICS | CAMERA TYPES | | |
|---|---|---|---|
| | 298 | 299 | 302 |
| Lens* | f/1.5, 50 mm focal Length 7-element lens | f/1.9, 75 mm focal Length 6-element lens or f/2.8, 75 mm focal Length 3-element lens | Same as 299 |
| Maximum writing rate (P11 screen at 29 kv) | Approximately 200 in/mμsec Using E.K. Super XX film | Approximately 80 in/mμsec (with f/1.9 lens) or 40 in/mμsec (with f/2.8 lens) Using E.K. Super XX film | Approximately 8 in/mμsec (with f/1.9 lens) or 4 in/mμsec (with f/2.8 lens) Using Polaroid Type 41 film |
| Object/Image Ratio | 5:1 | 2.25:1 | Same as 299 |
| Shutter* | Alphax No. 3 | Alphax No. 3 (with f/1.9 lens) or Alphax No. 2 (with f/2.8 lens) | Same as 299 |

## TABLE 1-1.
## TECHNICAL SUMMARY (Continued)

| CHARACTERISTICS | CAMERA TYPES | | |
|---|---|---|---|
| | 298 | 299 | 302 |
| Exposure Selection | Time, Bulb, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, 1 sec | Time, Bulb, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, and 1 sec. using No. 3 shutter and f/1.9 lens<br>or<br>Bulb, 1/100, 1/50, and 1/25 sec. using No. 2 shutter and f/2.8 lens | Same as 299 |
| Diaphragm Calibration | f/1.5, f/2.0, f/4.0, f/5.6, and f/8.0 | f/1.9, f/2.8, f/4.0, f/5.6, f/8.0, f/11, and f/16.0 using No. 3 shutter and f/1.9 lens<br>or<br>f/2.8, f/4.0, f/5.6, f/8.0, f/11.0, f/16.0, and f/22.0 using No. 2 shutter and f/2.8 lens | |
| Camera Back* | Du Mont Type 2616 No. 120 Roll Film Holder<br>or<br>Du Mont Type 2617 Sheet Film Holder<br>or<br>Du Mont Type 2619 Film Pack Holder<br>or<br>Other Graflok accessories | Same as 298 | Polaroid Model 95 (Du Mont Type 2620) |
| Print Size | 2¼" x 3⅛" | Same as 298 | 2⅞" x 3¾" |
| **DIMENSIONS** | | | |
| Over-all Length | 15½ inches | Same as 298 | Same as 298 |
| Height | 11 inches | Same as 298 | 10 inches |
| Width | 6 inches | Same as 298 | Same as 298 |

**PHYSICAL CHARACTERISTICS**

| | |
|---|---|
| Weight | 10 lbs. |
| Finish | Blue-gray wrinkle over-all; black graphic accessories |

* Optional, depending on sales order.

# SECTION 2
# DETAILED DESCRIPTION

## 2-1. GENERAL

The Du Mont Types 298, 299, and 302 are specially designed Oscillograph-record Cameras consisting of the following major components: *Housing, Mounting Plate, Data-recording Facility, Sliding Adapters and Film Holders,* and *Optical System.*

## 2-2. DESCRIPTION OF MAJOR ASSEMBLIES (Figure 2-1)

### a. Housing

The housing is of aluminum die-cast construction which is the basic piece of the camera assembly and houses the optical and data-record systems. The right side of the housings contain the lens access door through which the lens, iris diaphragm, and shutter may be adjusted. All housings are provided with an adapter clamp ring for attachment to an oscillograph equipped with a standard Du Mont Type 2501 bezel or equivalent.

A threaded insert, for attachment to a Tripod, is incorporated in the bottom of the housings, permitting the use of the camera on oscillographs not equipped with a bezel.

### b. Mounting Plate

The mounting plate is an aluminum die-casting, grooved to accommodate the sliding adapter. It incorporates the lens tube. Three equally spaced detents are provided for use in positioning the film holder for recording three equally spaced oscillo-

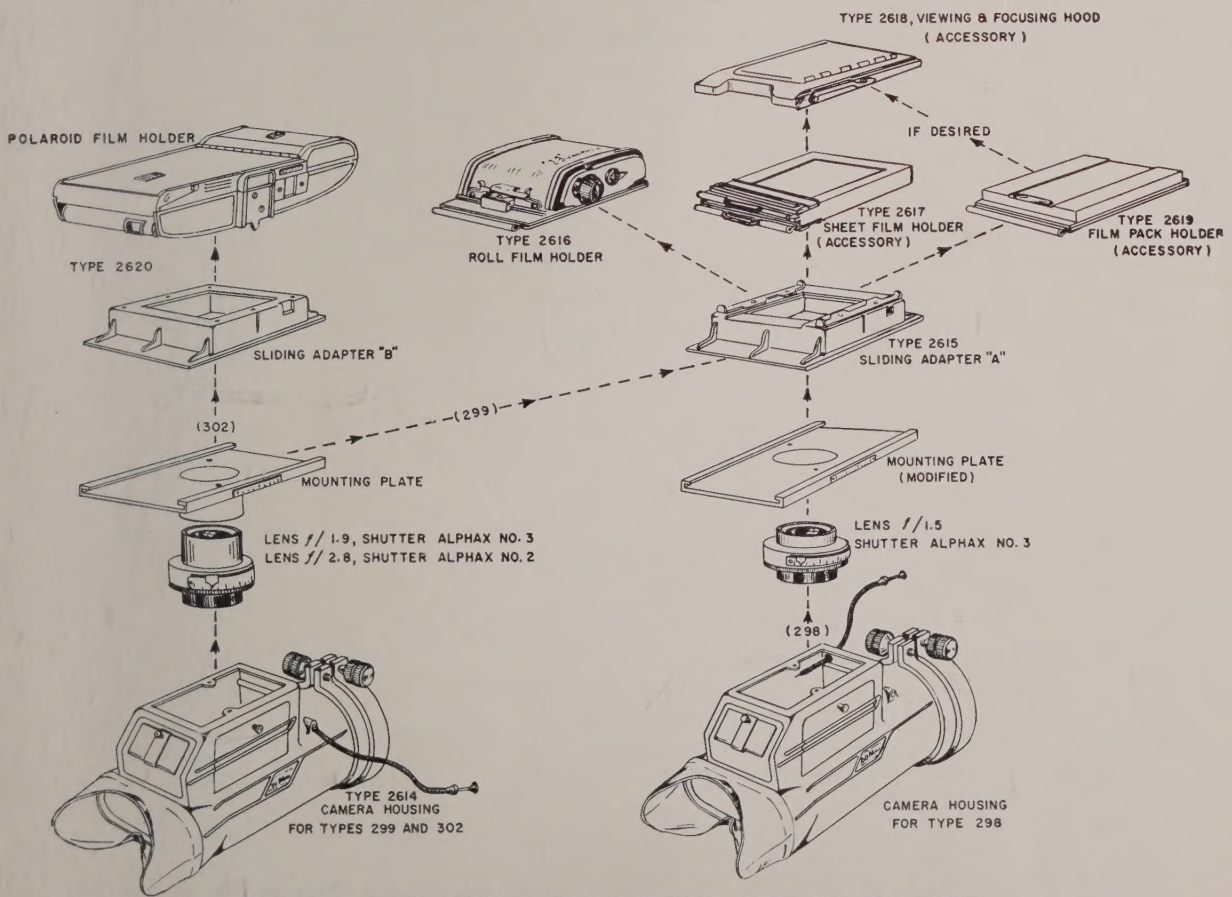



FIGURE 2-1. EXPLODED VIEW OF MAJOR COMPONENTS (TYPES 298, 299 AND 302)

# section 2
# detailed description

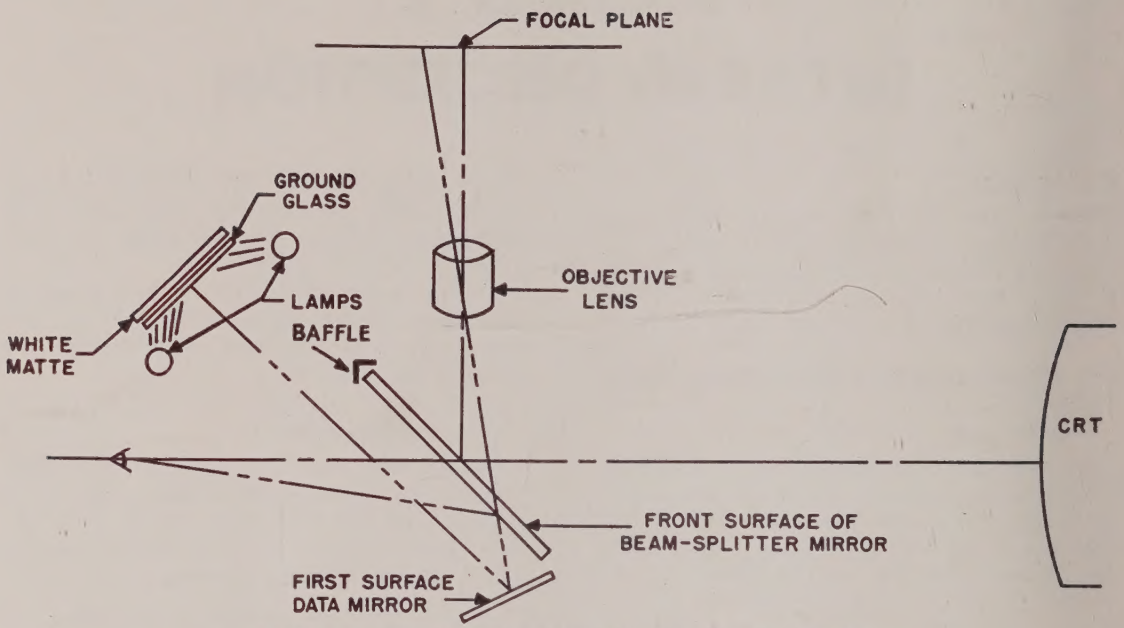



FIGURE 2-2. OPTICAL SYSTEM OF TYPES 298, 299, AND 302 CAMERAS

grams on a single frame of film. The mounting plate is identical for the Types 299 and 302. For the Type 298 the lens tube is shorter to accommodate the shorter focal length of the f/1.5 lens.

### c. Data-Recording Facility

This facility contains two lamps, a push-button switch, a data-recording surface, and a dry cell located at the top of the camera housing just above the eye shield.

A window in the data-record assembly is fitted with a spring return door which is covered on the inner side with a white plastic surface. A ground-glass light diffusing plate covers the opening under the door.

For the Types 298 and 299 Cameras, data is inscribed on the white plastic surface; for the Type 302 Camera, data is inscribed on the ground-glass surface. Data recorded in this manner retains the proper relationship to the oscillogram.

### d. Sliding Adapter and Film Holders

The sliding adapters are of die-cast aluminum and slide in the grooves provided in the mounting plate. A spring-loaded ball bearing is incorporated on one side, to engage in the three equally spaced depressions to provide detent action.

Adapter "A" is equipped with Graflok slide-locks to accommodate the standard Graflex "23" Roll Film Holder and is common to the Types 298 and 299 cameras.

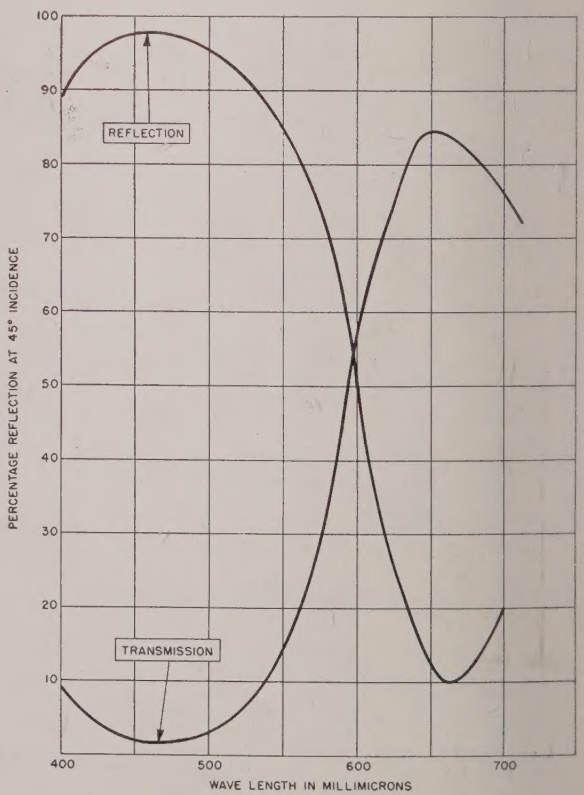



FIGURE 2-3. SPECTRAL REFLECTION AND TRANSMISSION CURVES OF DICHROIC MIRRORS

Adapter "B" fits inside the Polaroid Film Holder and is only used with the Type 302 camera.

### 2-3. OPTICAL SYSTEM (Figure 2-2)

The Types 298, 299, and 302 optical system contains the lenses described in Table 1-1 and the components shown in the Figure 2-2.

Lenses are of the Wollensak-Du Mont CRO oscillo-anastigmat type specifically designed to efficiently record oscillograms. All air-to-glass surfaces of the lens elements are coated to minimize reflections.

The dichroic mirror is of the interference type which is more efficient than the partial reflecting metallic coated type of mirror. An interference mirror consists of a number of transparent dielectric films of precisely controlled thickness deposited on flat glass. When the films are properly arranged with regard to their number, thickness, and refractive index, a chromatic selection takes place in which a certain portion of the spectrum is reflected and the remainder is transmitted. Thus, the name "dichroic" is given to this beam splitter.

The dichroic beam splitter used is designed to reflect actinic light (blue) and transmit yellow light when the light rays are incident at 45°.

A spectral reflectance characteristic curve of the dichroic mirror is shown in Figure 2-3. These curves refer only to a 45° incidence angle for which the optical system was designed. By the use of this mirror, simultaneous direct binocular viewing and recording is possible.

# SECTION 3
# INSTALLATION AND OPERATION

### 3-1. INITIAL INSPECTION OF CAMERA (See Figures 3-1 through 3-4)

The following inspection procedure is suggested before mounting the camera on the oscillograph:

Step 1. Open the viewing door and examine the dichroic and data-card mirrors for surface dust. Clean only with a fine camel-hair brush. The mirrors should not be moved or removed while cleaning.

Step 2. Open lens-access door and check operation of iris diaphragm and shutter control. The shutter is controlled by rotating the knurled ring located below pointer on the lens assembly. The iris diaphragm is controlled by sliding the pointer located above the knurled ring to the desired position.

Step 3. To install dry cell, open data-record door and remove the two screws on rear data card door assembly.

Step 4. Lift out assembly exposing data-record compartment.

Step 5. Snap dry cell in place and check operation of lamps by depressing red push-button switch.

Step 6. Replace assembly and screws.

### 3-2. MOUNTING CAMERA

Step 1. Remove adapter clamp ring from camera housing and secure it to the bezel of the oscillograph.

Step 2. Insert camera housing into adapter clamp ring and press firmly against face of cathode-ray tube or scale if present. Secure the adapter clamp ring by turning knurled knob counterclockwise.

It is not necessary to remove the camera assembly from the oscillograph when loading the film or when recordings are not being made. It forms a convenient viewing shield for observing phenomena on the cathode-ray tube in a brightly illuminated room.

### 3-3. SELECTION OF FILM OR PAPER

#### a. Types 298 and 299

Use one of the 2¼″ x 3¼″ black and white films listed in Table 4-1.

#### b. Type 302

Polaroid-Land film Types 41, 42, and 44 (black and white), are available at most photographic supply stores. A single loading pack contains enough material for eight 3¼″ x 4¼″ frames.

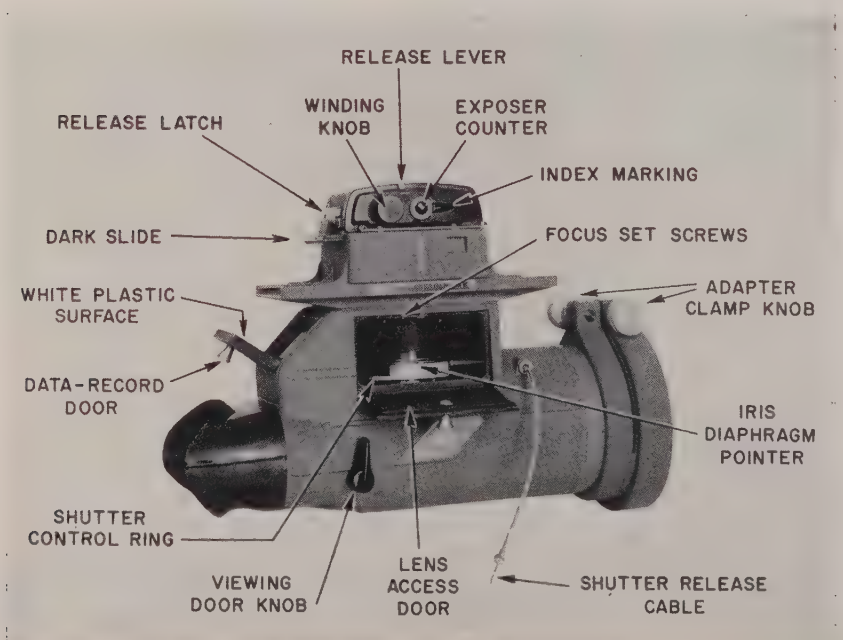



FIGURE 3-1. IDENTIFICATION OF COMPONENTS (RIGHT SIDE), TYPE 298 OR 299 OSCILLOGRAPH-RECORD CAMERAS

Note: Cable release positioned at point "X" on the Type 298. (See Figure 3-2.)

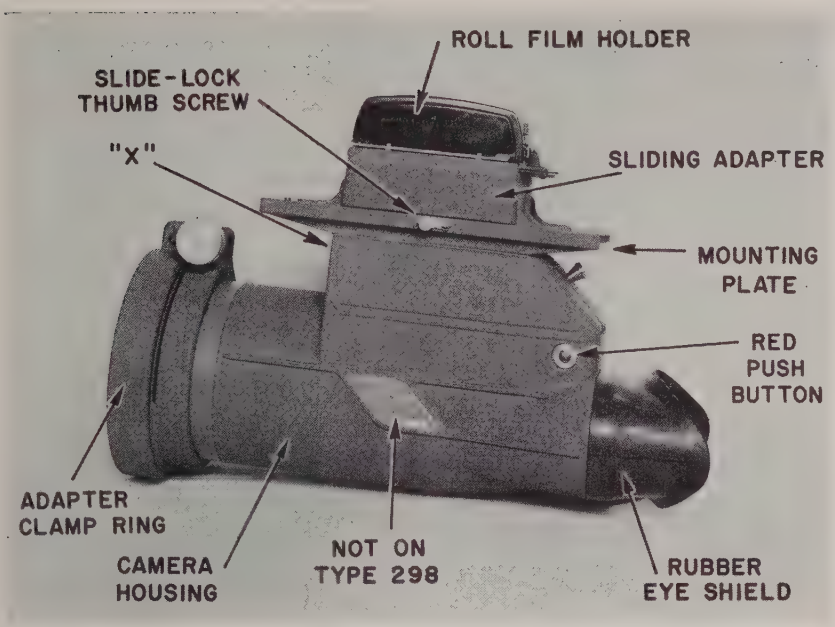



FIGURE 3-2. IDENTIFICATION OF COMPONENTS (LEFT SIDE) TYPE 298 OR 299 OSCILLOGRAPH-RECORD CAMERAS

Note: Shutter release cable positioned at point "X" on Type 298.

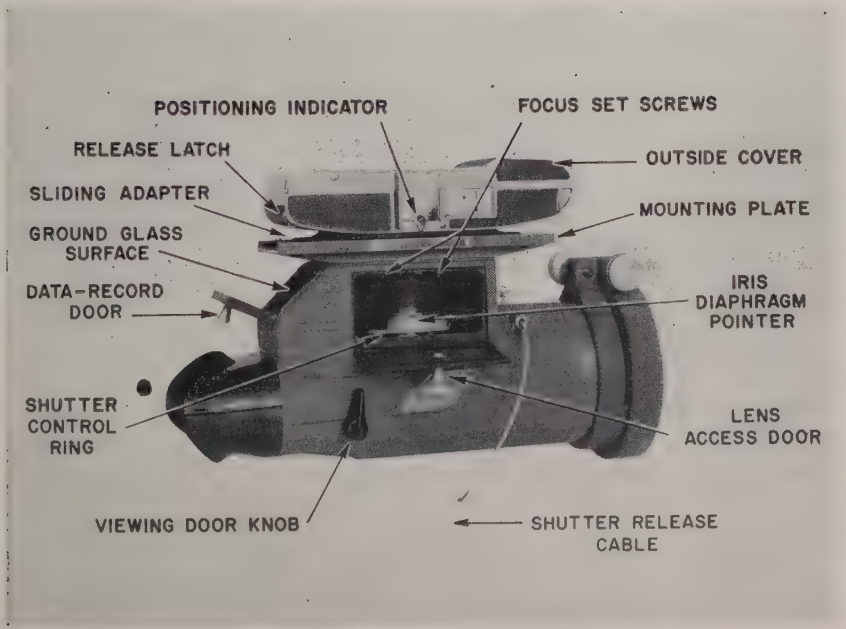



FIGURE 3-3. IDENTIFICATION OF COMPONENTS (RIGHT SIDE) TYPE 302 OSCILLOGRAPH-RECORD CAMERA

# section 3
# installation and operation

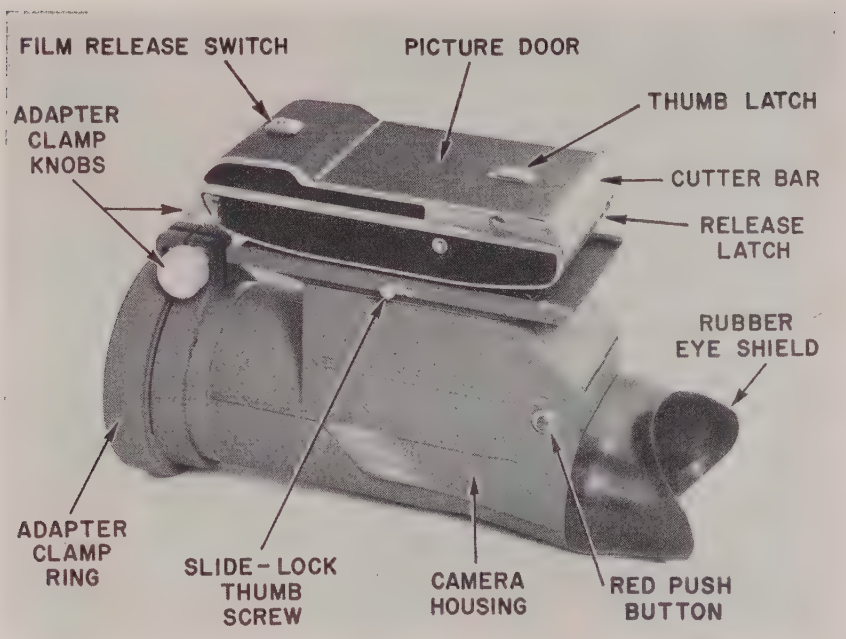



FIGURE 3-4. IDENTIFICATION OF COMPONENTS (LEFT SIDE) TYPE 302 OSCILLOGRAPH-RECORD CAMERA

### 3-4. LOADING INSTRUCTIONS (TYPES 298 AND 299)

Step 1. Place *roll-film holder* face down as shown. Squeeze *release latches* together and lift to open *cover*.

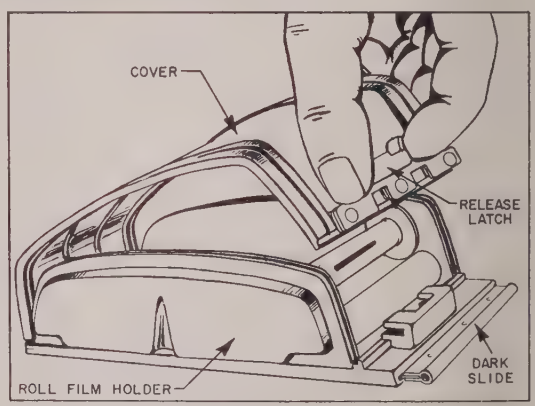



FIGURE 3-5.

Step 2. Remove *film carriage*.

Step 3. Load film *spool* into rear cavity by tipping edge of spool into cavity and pressing downward against spring until spool can be slipped into position.

Step 4. While holding release lever to the left turn *winding knob* until No. 8 on *exposure counter* passes the *index mark* and stops. (See Figure 3-8.)

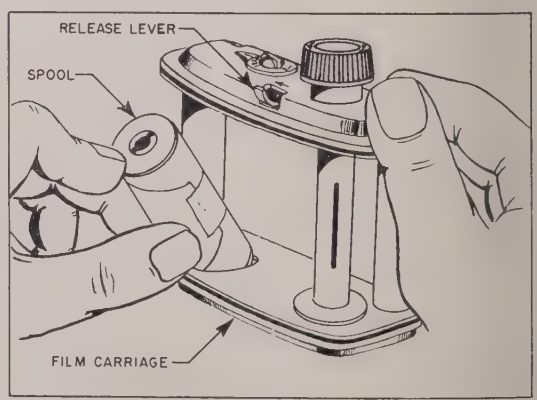



FIGURE 3-6.

Step 5. Unwind leader, keeping black side outward, and pass it around front of film carriage to the *take-up spool.*

Step 6. Thread paper to *take-up spool* and turn winding knob until arrow on paper is opposite *film index arrow* on carriage.

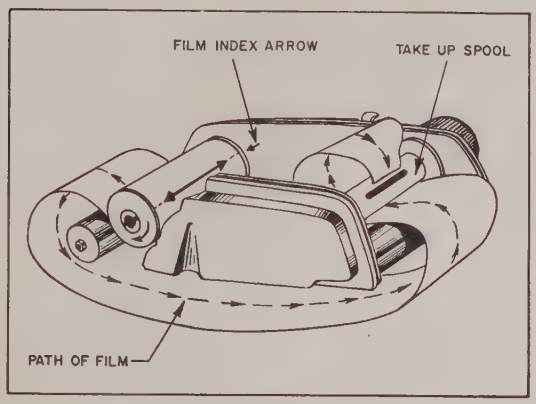



FIGURE 3-7.

Step 7. Set *exposure counter* to "S" by turning it in direction of arrow. Replace film carriage in roll-film holder and snap cover in place.

Step 8. Turn *winding knob* in direction of arrow until exposure counter automatically stops at No. 1, indicating that film is in position for making first exposure. This completes the loading operation.

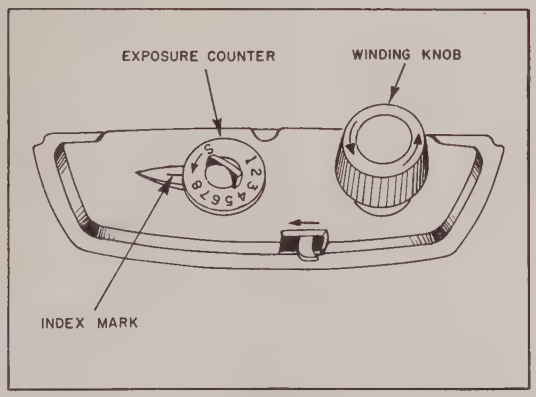



FIGURE 3-8.

### 3-5. TAKING THE PICTURE WITH THE TYPES 298 AND 299

Due to the wide variations in the intensity of the cathode-ray tube pattern, which is affected by tube voltage, intensity control setting, condition of tube and type of screen, it is difficult to tabulate exact information to enable perfect recordings to be made immediately. Some experimentation, in the form of test shots, will be required to determine optimum conditions for each particular case.

**CAUTION**

To prevent damage to the screen of the cathode-ray tube, open the viewing door and observe pattern while making intensity adjustments.

### 3-6. RECORDING DATA ON FILM (TYPES 298 AND 299)

To avoid overlapping the data and the waveform on the photograph, hold the red push-button depressed, imposing the data-record image on the screen of the cathode-ray tube; then make adjustments to correct any overlapping.

Step 1. Open *data-record door.*

Step 2. Record data (using soft pencil) on *white surface.*

Step 3. Close *data-record door.*

Step 4. Hold *red push button* depressed. This illuminates the data card surface.

Step 5. Make exposure using settings determined from Table 4-2.

### 3-7. OPERATING PROCEDURE (TYPES 298 AND 299)

Step 1. Open the *lens access* door.

Step 2. Set the shutter speed by rotating the *knurled ring.*

Step 3. Set desired "f" number by sliding *pointer* over iris diaphragm scale.

Step 4. Close the *lens access door* after making adjustments.

Step. 5. Loosen *slide-lock thumb screw,* position the roll film holder as desired and lock.

Step 6. Open the *viewing door* and check waveform for proper size and intensity. Close viewing door.

NOTE: Simultaneous viewing and exposure is possible while the *viewing door* is open providing direct light does not enter the eye shield.

Step 7. Remove *dark slide* from the film holder.

Step 8. Make the exposure.

Step 9. After exposure is made, push *release lever* in the direction indicated on the film holder. Turn winding knob until *exposure counter* automatically stops on the next position.

Step 10. After making the last exposure, replace *dark slide.* Trip *release lever* and turn *winding knob* until remaining film is completely wound on the spool.

Step 11. Open cover. Push downward on spool, depressing retaining spring, tilt and remove.

For processing technique refer to Section 5.

### 3-8. LOADING INSTRUCTIONS (TYPE 302)

It is recommended that the Type 302 be mounted on an oscillograph before loading, to facilitate this operation. (For instruction on mounting the Type 302 Camera on an oscillograph, refer to paragraph 3-2.)

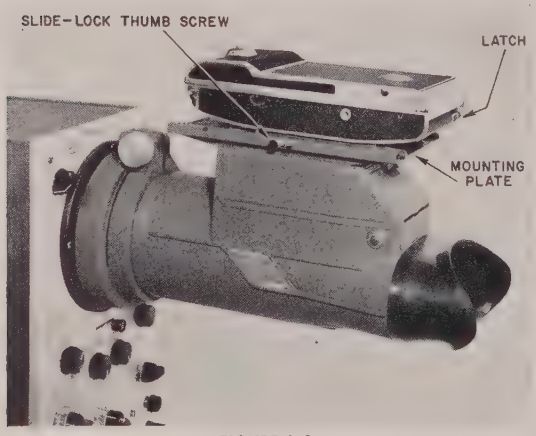



FIGURE 3-9.

Step 1. Loosen *slide-lock thumb screw,* and slide camera until latch clears end of mounting plate.

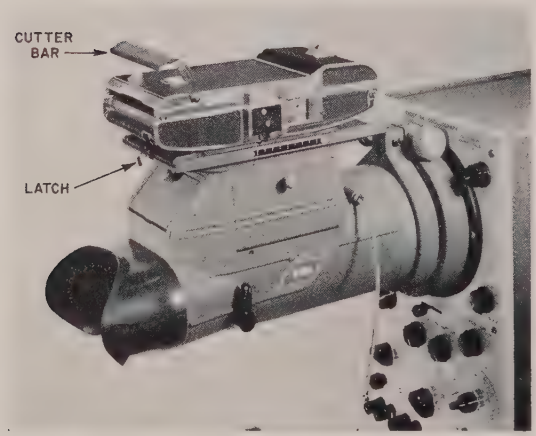



FIGURE 3-10.

Step 2. Lift the *cutter bar* by applying a firm but gentle pressure at the base of the bar.

Step 3. Unlock cover by swinging *latch* down and to the left.

Step 4. Lift the *outside* and *inside* covers and lay them back. (If the camera has been used previously, remove and discard the empty spool.) Wipe the two steel rollers clean.

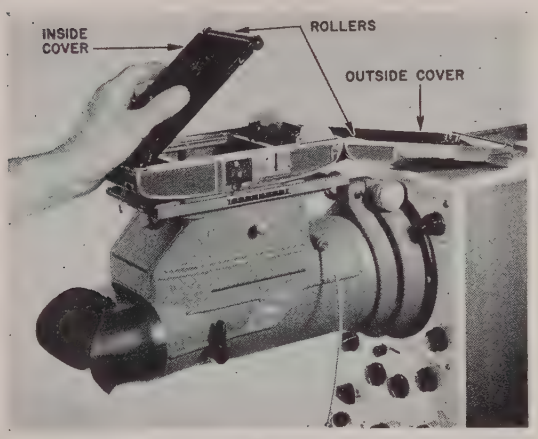



FIGURE 3-11.

Step 5. Unroll the film wrapper (being careful not to break the scotch tape seal); press the *spool* firmly into place in the slots provided, and drop the *paper roll* into its compartment.

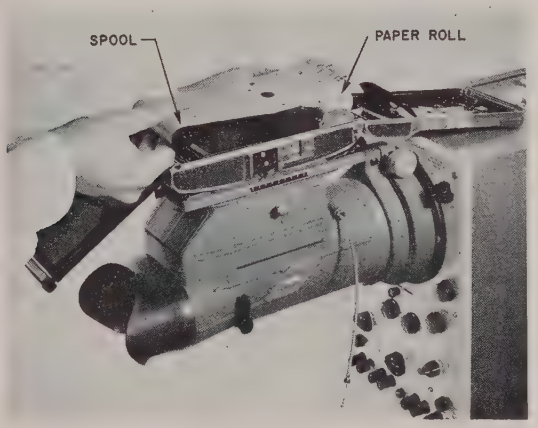



FIGURE 3-12.

Step 6. Hold *leader* out and close *inside cover*.

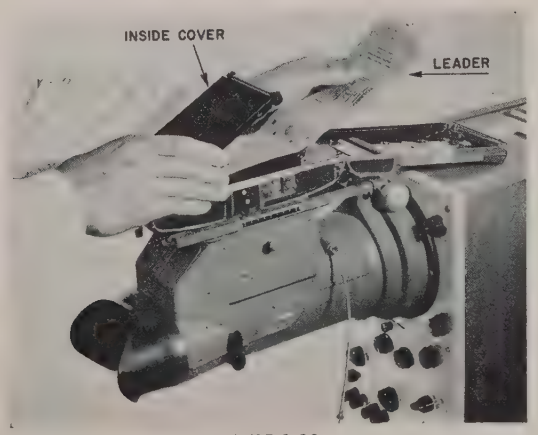



FIGURE 3-13.

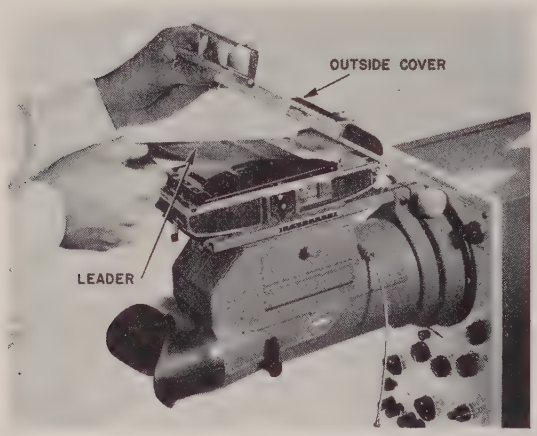



FIGURE 3-14.

Step 7. Grasp the end of the *leader* and fold it back over the steel rollers while swinging the *outside cover* closed.

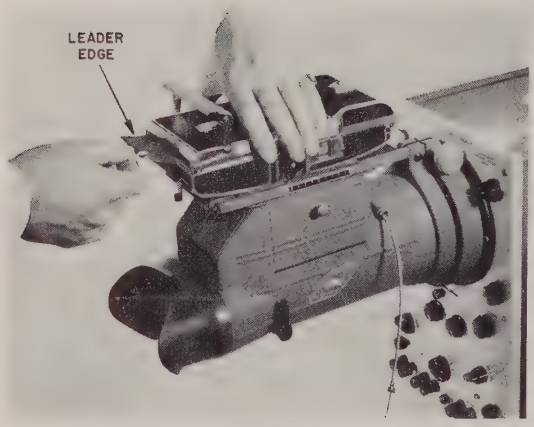



FIGURE 3-15.

Step 8. When swinging the *outside cover* closed, make sure that the edge of the *leader* protrudes as shown.

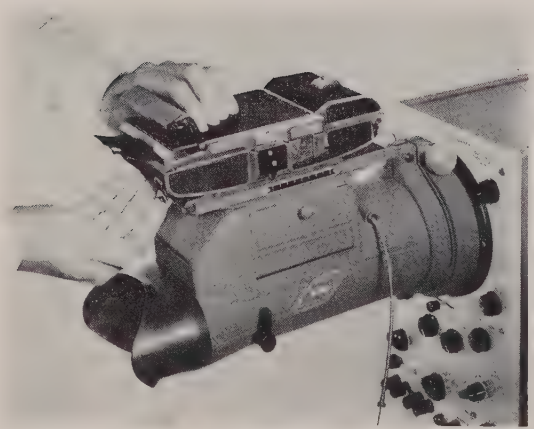


FIGURE 3-16.

Step 9. Lock the *outside cover* by swinging the *latch* downward to the left and hold there while pressing down on the *outside cover* to engage the locking catch. Continue to press downward on the *outside cover* with one hand while swinging the *latch* up and to the right as shown.

Step 10. Grasp the edge of the protruding leader and pull straight out until it stops automatically and the word "stop" appears.

FIGURE 3-17.

Step 11. Hold the *cutter bar* down firmly with the thumb as shown, tear off and discard the leader. This completes the loading operation and readies camera for first exposure.

NOTE: Before making first exposure set shutter and iris diaphragm and check waveform for proper size and intensity. (See paragraphs 3-6 and 3-7.)

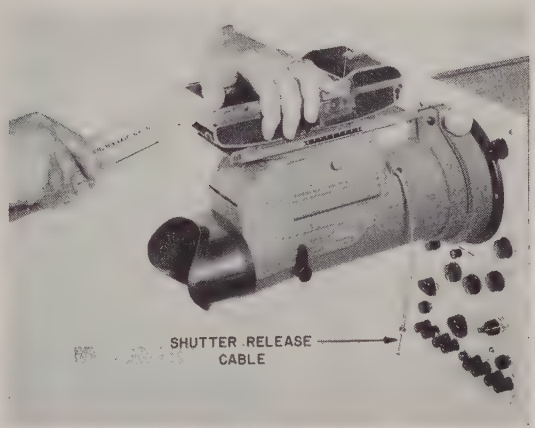



FIGURE 3-18.

### 3-9. RECORDING DATA ON FILM (TYPE 302)

Using a soft pencil, write the desired information on the *ground-glass* surface. See paragraph 3-6 and Table 4-1 for proper exposure time and other pertinent information.

### 3-10. TAKING PICTURE AND PROCESSING (TYPE 302)

Step 1. Make first exposure by depressing *shutter release cable.*

Step 2. After making exposure (make sure camera is locked in place) lift the *cutter bar* and snap *film release switch.*

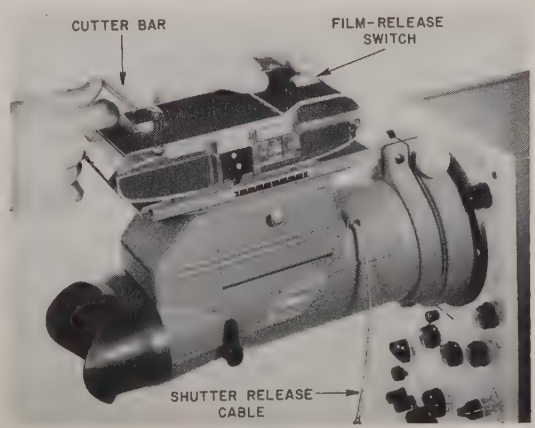



FIGURE 3-19.

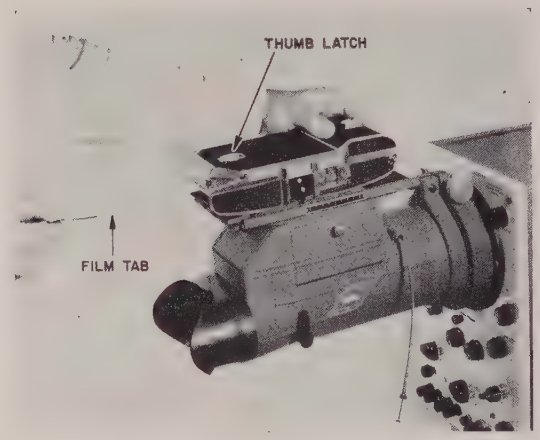



FIGURE 3-20.

Step 3. Grasp the edge of the protruding *film tab* and pull straight out until it stops automatically This starts the Polaroid process and automatically advances film for the next exposure. If desired, the next exposure could be made during the 60-second processing period.

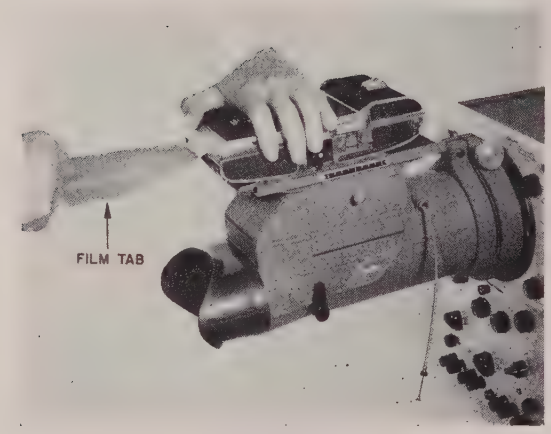



FIGURE 3-21.

Step 4. Lower the *cutter bar* and hold it down firmly with your thumb; tear off the *film tab*.

**CAUTION**

If you forget to lower and hold down the cutter bar while tearing film tab off, the tab will be lost for the next frame. If this happens, wait approximately one minute and open the picture door; then inch the paper forward.

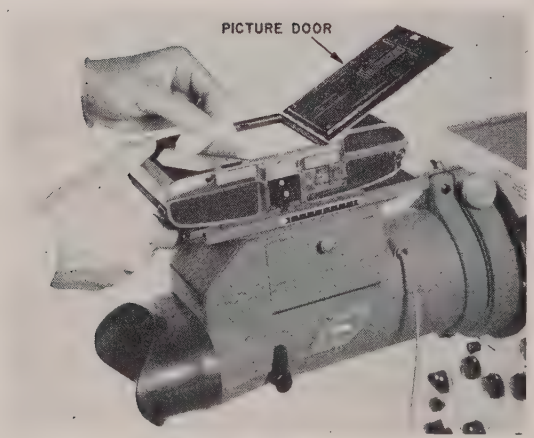



FIGURE 3-22.

Step 5. After waiting approximately 60 seconds, for the processing, open the *picture door* by sliding the *thumb latch* forward. Remove print by lifting carefully along the perforations. Close and lock picture door.

After the first print has been processed, the discarded tabs will be the negatives from previous prints.

Repeat sequence until all exposures have been made.

NOTE: To avoid scratches and finger prints on the fresh print handle it by the tab or border.

Step 6. Flatten print by drawing over table edge and coat with Polaroid Print Coater.

### 3-11. REPRODUCTION OF POLAROID-LAND PRINTS

The Polaroid-Land process ordinarily does not yield a negative suitable for reproduction as in the conventional photographic process. The common procedure for obtaining reproductions is to have the print photo-copied; the new negative is then used to make the desired number of prints. It is possible, however, to fix permanently the original paper negative. The following procedure is recommended.

Step 1. Make the recording and commence the processing as outlined in paragraph 3-10 of this section.

Step 2. Approximately one minute after starting the processing, place a black cloth over the top of the camera and open the *picture door.*

Step 3. Peel off the print and immediately close the *picture door.* The paper negative of this print remains in the camera and will not fog as long as it is not exposed to light.

Step 4. When starting the processing of the next print pull the paper negative of the previous print out (under cover of a black cloth or in a darkened room) ; tear off the paper negative and immediately immerse it in a hypo solution.

Step 5. Leave the paper negative in the hypo solution for approximately two minutes; meanwhile the next exposure can be made. A concentrated hypo solution is recommended.

Step 6. After fixing, the paper negative may be washed and dried in the usual manner.

Step 7. Print the paper negative by placing its emulsion side in contact with the emulsion of the printing paper and expose through the negative. Process the print in the usual manner.

To improve the appearance of the print, rub the back of the paper negative with oil, vaseline or melted wax to render it more translucent, this facilitates the transmission of light through the paper negative for contact printing.

In a similar manner the Polaroid print itself may be reproduced. However, in this case, a contact negative will result. Advantage can be taken of this effect by contact-printing the Polaroid print on a sheet of negative material for subsequent use in making any desired number of positive duplicates.

# SECTION 4
# EXPOSURE DETERMINATION

## 4-1. GENERAL

For most applications of photo-recording with the Du Mont Oscillograph-record Cameras, *bulb* operation of the shutter will be employed. A few of the factors which affect the setting of the iris diaphragm and which determine the exposure time interval are:

(*1*) The over-all accelerating potential of the oscillograph.
(*2*) The actual brightness setting of the cathode-ray oscillograph.
(*3*) The amplitude of the pattern on the cathode-ray screen.
(*4*) Whether the sweep is "recurrent" or "driven."
(*5*) Sweep repetition rate.
(*6*) Whether the pattern is stationary, jittery, or drifting.
(*7*) The number of cycles appearing on the screen.
(*8*) The age of the particular cathode-ray tube.
(*9*) The type of screen phosphor.
(*10*) The type of film used in the camera.

Aside from the above list, a number of other conditions would have to be considered in order to calculate the exact exposure for every conceivable situation. *Test shots* therefore, provide the best means for determining correct exposure time under a given set of conditions. A comprehensive discussion of exposure determination is beyond the scope of this manual but may be found in the literature on photo-recording.[1]

To photograph stationary patterns, open the camera shutter for at least the duration of one sweep cycle in order to avoid losing part of the pattern.

For single-transient recording, the aperture is generally set at maximum opening with the shutter being opened before the transient occurs and closed after it is over. For best results in a particular application several test exposures should always be made.

## 4-2. RECORDING MATERIALS FOR THE TYPES 298 AND 299

Table 4-1 indicates that Tri-X (or equivalent) with an emulsion speed of 2.6 is best suited for oscillography.

Data for comparable film characteristics is readily available from the various film manufacturers, providing the user with a wide range of emulsion speeds.

[1] See "Techniques of Photo Recording From Cathode-ray Tubes" published by the Technical Products Division of Allen B. Du Mont Laboratories.

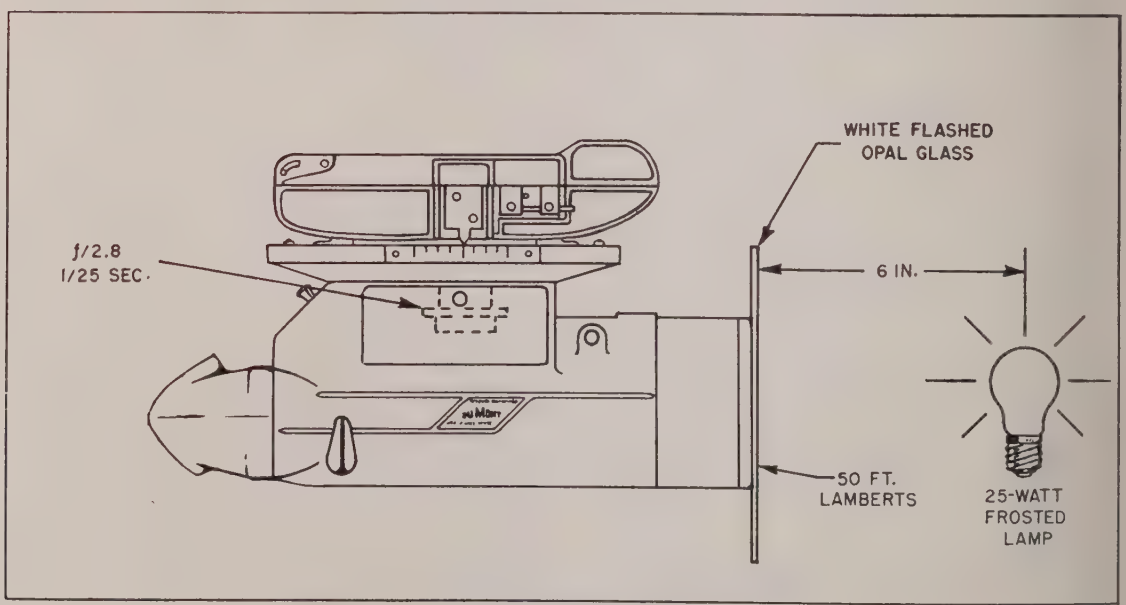



FIGURE 4-1. METHOD OF PRESENSITIZING POLAROID-LAND FILM

## TABLE 4-1.
## RECORDING MATERIALS

| FILM TYPE | RELATIVE EMULSION SPEEDS* |
|---|---|
| Roll or Film Pack | |
| E.K. Tri-X Pan | 2.6 |
| E.K. Super XX | 1.0 |
| E.K. Plus X | 0.5 |
| Sheet Films | |
| E.K. Royal Pan | 2.6 |
| E.K. Super XX | 1.0 |

* These ratings are based on actual tests of writing rate capabilities for high-speed single transients. (A.S.A. speed index rates do not necessarily indicate writing rate capabilities.)

### 4-3. RECORDING MATERIAL FOR THE TYPE 302

The Type 41 emulsion is generally available and yields black and white prints. Refer to Table 1-1 for writing rates for this emulsion. Types 42 and 44 are recent additions to the Polaroid line at the time of this writing and may only have limited availability. They are known to yield higher writing rates than Type 41 but have not been analyzed at this writing.

### 4-4. PRESENSITIZING POLAROID-LAND FILM (See Figure 4-1)

The available Polaroid-Land recording material is not as good as conventional film for photographing high-writing speeds. It is possible to greatly increase the actual photographic writing speed of the Polaroid material by presensitizing the emulsion before the pictures are made. The recommended procedure is as follows:

Step 1. Load the film into the camera.

Step 2. Set up the camera as shown in Figure 4-1 against a sheet of white opal glass six inches away from a 25-watt incandescent lamp.

Step 3. Expose for 1/25 of a second at f/2.8. An increase of maximum photographic writing speed by as much as eight times can often be obtained.

### 4-5. DATA-RECORD EXPOSURE

For the Types 298 and 299 Cameras, data is inscribed on the white plastic surface; for the Type 302 Camera, data is inscribed on the ground-glass surface. Data recorded in this manner retains the proper relationship to the oscillogram.

Table 4-2 may be used to calculate the approximate proper exposure time for the illuminated data surface. When exposures several times longer than the value listed in Table 4-2 are required, the leak-proof dry cell should be replaced. The exposure times and aperture settings which yield optimum results depend upon: (1) the softness of the pencil used and (2) the amount of pressure used in writing on the ground-glass or white plastic surfaces.

## TABLE 4-2.

| OPTIMUM DATA-RECORD EXPOSURE FOR DU MONT OSCILLOGRAPH-RECORD CAMERAS | |
|---|---|
| Illumination: 2 Mazda No. 112 Lamps<br>1 Leak Proof, Size C, Dry Cell | |
| Aperture | Time—Seconds |
| f/1.9 | ½ |
| 2.8 | 1 |
| 4 | 2 |
| 5.6 | 4 |

Eradication of data from the ground-glass or the white-plastic surface is easily accomplished by the use of a good pencil eraser.

During exposure the data may be observed through the eye shield. If higher contrast is desired than can be obtained from using a pencil, the data may be

FIGURE 4-2. OSCILLOGRAM ILLUSTRATING DATA-RECORD AND THREE EQUALLY SPACED WAVEFORMS ON ONE FRAME

written in black ink on a strip of thin vellum. The strip of vellum can be inserted between the ground-glass surface and the data-record door. Writing on a carbon-backed strip of white paper will also photograph well.

### 4-6. EXPOSURE OF SEVERAL WAVEFORMS AND DATA RECORD ON A SINGLE PRINT

To make a series of consecutive (but not superimposed) exposures, along with the data-record, on a single print, the following procedure is recommended.

Step 1. Slide the camera to its extreme forward position.

Step 2. Remove signal from screen and turn off scale lights.

Step 3. Expose the data-record.

Step 4. Position the trace in the center of the screen and adjust the amplitude to not more than 1.5″ to prevent overlapping of the trace on the data-record.

Step 5. Leaving camera in forward position, record the first oscillogram.

If three equally-spaced oscillograms are desired on one print, the camera may be so positioned by the three equally-spaced detents provided.

When more than three oscillograms are required per print the camera may be moved in incremental steps using the *positioning pointer* and the calibrated scale as a guide.

**NOTE: Processing technique for the Types 298 and 299 Cameras is given in Section 5.**

# SECTION 5

# PROCESSING AND EVALUATION OF RECORDINGS

## (Types 298 and 299)

### 5-1. PROCESSING

#### a. Development

For processing records of stationary patterns or low-speed transients, a developer such as Kodak D-76 is satisfactory. Develop for sixteen minutes at 68° F. When higher contrast or shorter development time is required, use either Kodak D-72 diluted 1:1 for three minutes at 68° F or Kodak D-19 full strength for six minutes at 68° F. For recordings of high-speed transients, the highest writing rates will be obtained by prolonged development in D-19 full strength for nine minutes at 70° F. Other methods such as presensitizing, latensification, and intensification sometimes increase the effective film emulsion speed; however, very carefully controlled conditions are necessary to achieve even a slight improvement.

#### b. Fixing

After development, the film should be fixed in any of the standard acid-fixing solutions or those recommended by the film manufacturer.

#### c. Washing

The film should be washed at least 20 minutes in running water if the recordings are to be kept for an extended period.

#### d. Drying

With normal development procedure, film should be hung up to dry in still air so that dust does not collect on it. A weight should be hung at one end of the film to prevent curling. The film is dry when the emulsion side ceases to curl outward and becomes shiny.

Quick drying procedures may be used, such as dipping the film in 90% alcohol or in a saturated solution of potassium aluminum sulphate. After dipping, they should be wiped dry immediately with a soft chamois or cellulose sponge and hung up to dry.

### 5-2. STUDY AND EVALUATION OF RECORDINGS

#### a. Calibration

Accurate calibration of recordings may be made by superimposing the output of a Du Mont Type 264-B Voltage Calibrator on the pattern under study. In the case of dual-beam oscillographs, one channel may be used to record the calibration while the other records the phenomena when properly set up.

#### b. Mounting

Individual frames may be cut from the film strip and mounted in standard lantern slides. Mounting the films directly avoids having to make positive transparencies, although for permanent slides positive transparencies are advised.

### 5-3. THE POLAROID-LAND PROCESS (See Figure 5-1)

The Polaroid-Land photographic process is sometimes known as the soluble silver complex process.

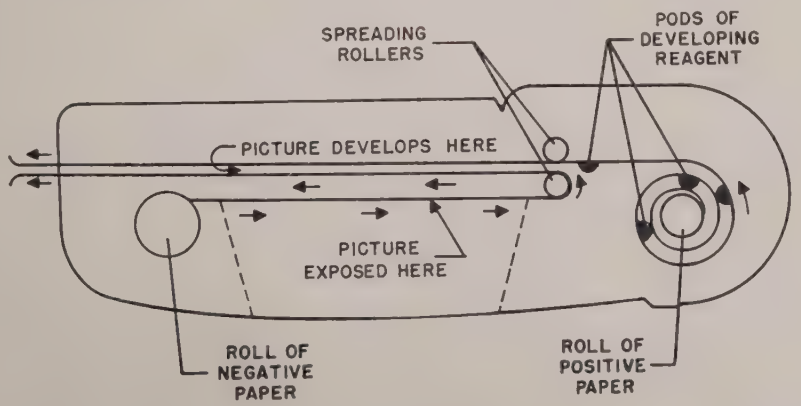



FIGURE 5-1. SCHEMATIC: POLAROID-LAND PROCESS

# section 5
# processing and evaluation

It involves the simultaneous development of both positive and negative images in adjacent layers of photographic material, the positive image being formed from the unexposed silver halide grains of the negative image. The adjacent layers in the Polaroid-Land process, consist of a paper negative halide emulsion, and a positive printing paper coated with crystals of metallic sulfide. Attached to the printing paper at the head of each frame, is a small air-tight "pod" which contains a chemical reagent and plasticizer. After exposure of the paper negative, the negative-emulsion surface and the positive-printing surface are pulled together and pressed firmly between steel rollers. Thus the pod is broken, and the jellied reagent is spread evenly in a thin film between the adjacent layers. The exposed grains of silver halide in the negative emulsion are thereby developed into metallic silver, while the unexposed silver halide grains are dissolved. These unexposed grains diffuse out of the negative emulsion into the immediately adjacent positive-printing surface. Sulfide crystals on the printing surface cause the silver solution to precipitate as a positive image on the printing surface. The entire process requires about 60 seconds at normal room temperatures. Since any excess developer is trapped and resealed, it is not generally possible for the operator to come into contact with the reagent during the normal operation of the camera. However, if occasion to examine the reagent arises, caution should be observed since the chemicals employed will stain clothing permanently.

# SECTION 6
# MAINTENANCE

## 6-1. GENERAL

The Types 298, 299, and 302 Cameras should be handled with the same care given to all fine optical equipment. Under no circumstances should an attempt be made to force-fit parts.

The focus should not be readjusted unless there is reason to believe from observing recordings that the camera is out of focus.

For the majority of the work the depth of field of the lens is sufficient to accommodate curved-faced cathode-ray tubes with the aperture wide open or with screens and filters inserted between the camera housing and Cathode-ray Oscillograph screen.

## 6-2. PREVENTIVE MAINTENANCE

### a. Lens, Shutter, and Mirrors

The lens and shutter have been carefully inspected at the factory. Should this assembly become defective at any time, the entire camera should be returned to the factory for repair. Shutter repairs shou'd not be attempted except by experienced camera technicians.

It may occasionally be necessary to remove dust particles from the dichroic and data-record mirrors or from the surface of the lens. These surfaces should be cleaned by dusting with a soft camel hair brush. The use of a lens cap is recommended.

### b. Lubrication

This equipment requires no lubrication. *Never oil or lubricate the shutter mechanism.*

### c. Dry Cell Replacement

The dry cell, located in the data-record compartment, should be replaced whenever the exposure time for making suitable data records becomes appreciably greater than the values listed in Table 4-2. To install the dry cell the following procedure is recommended.

Step 1. Open data-record door and remove the two screws located on rear data card door assembly.

Step 2. Lift out assembly exposing data-record compartment.

Step 3. Snap dry cell in place and check operation of lamps by depressing red push-button switch.

If camera is stored for long periods of time it is advisable to remove dry cell to prevent possib'e damage due to leakage.

### d. Adapter Clamp Ring

Since the camera housing is of die-cast construction, excessive expanding or tightening of adapter clamp ring should be avoided. Expanding the adapter clamp ring too far will cause the retainer rings to spring out of their grooves. Excessive tightening may crack die-casting.

### e. Storage

When camera is not in extended use it is suggested that it be stored in its carrying case or covered with a plastic bag.

## 6-3. REFOCUSING

### a. Types 299 and 302 Cameras

The lens of the camera has been set at the factory to be in optimum focus when the rubber trimmed end of the camera housing is in contact with the face of the cathode-ray tube.

If refocusing is necessary, proceed as follows:

Step 1. Mount the camera on the oscillograph.

Step 2. (For Type 299)—lay back cover of roll film holder and remove the film carriage and the dark slide. See Figure 3-5.

(For Type 302)—Open and lay back the outside and inside covers of camera. See Figures 3-11 and 3-12.

Step 3. Set the shutter on "time," the iris diaphragm to the smallest "f" number (largest lens opening) and depress the shutter release cable to open the shutter.

Step 4. Set the oscillograph to obtain a sharply focused stationary pattern centered on the cathode-ray tube screen.

> **CAUTION**
>
> To prevent damage to the screen of the cathode-ray tube, open the viewing door and observe pattern while making intensity adjustments. Keep intensity low.

Step 5. (For Type 299)—Place a sheet of 2½″ by 3½″ ground glass at the focal plane, directly over the lens, with the ground surface facing the lens.

(For Type 302)—Same as for the Type 299 except a 3⅜″ by 4¼″ piece of ground glass is used.

Step 6. While holding the lens assembly with one hand, slightly loosen the focus set-screws, on the lens tube portion of the mounting plate, to free the lens.

Step 7. While observing the image on the ground

glass with a magnifying glass, slide the lens assembly up and down until the sharpest focus is obtained.

Step 8. Lock the lens in place by tightening the focus set-screws.

When the lens is refocused for any reason, the data-record image in the focal plane should be checked and, if necessary, the data mirror readjusted for best focus and proper location of the image in the focal plane.

The mirror may be adjusted for correct focus by loosening the two screws, holding the data-record mirror bracket and moving mirror in a horizontal direction.

**b. Type 298 Camera**

All general information contained in paragraph 6-3a, except the step-by-step refocusing procedure is applicable for the Type 298 camera. If refocusing of the Type 298 is necessary proceed as follows:

Step 1. Mount the camera on the oscillograph.

Step 2. Lay back cover of roll film holder and remove carriage and dark slide. See Figure 3-5.

Step 3. Set the shutter on "time," the iris diaphragm to the smallest "f" number (largest lens opening) and depress the shutter release cable to open shutter.

Step 4. Set the oscillograph to obtain a sharply focused stationary pattern centered on the cathode-ray tube screen.

> **CAUTION**
>
> To prevent damage to the screen of the cathode-ray tube, open the viewing door and observe pattern while making intensity adjustments. Keep intensity low.

Step 5. Place a sheet of 1½" by 3" ground glass at the focal plane, directly over the lens, with the ground surface facing the lens.

Step 6. Turn up the three adjustment screws located on top of the mounting plate, accessible through sliding adapter, until the screw heads are flush with top of mounting plate, enabling full travel of the lens assembly.

Step 7. While holding the lens assembly with one hand, slightly loosen the focus set-screw, located below the center of the calibrated scale, on the mounting plate.

Step 8. While observing the image on the ground glass with a magnifying glass, slide the lens assembly up and down until the sharpest focus is obtained.

Step 9. Lock the lens in place by tightening the focus set-screw.

Step 10. Turn down the three adjustment screws until they come in contact with the shutter housing. (DO NOT USE FORCE.)

Step 11. While holding the lens assembly with one hand, loosen the focus set-screw and apply a slight upward pressure on the lens assembly to allow the lens assembly to seat itself against the three adjustment screws.

Step 12. Check the image on the ground glass to determine if the image at the edges of the field is uniformly sharp.

Step 13. If adjustment is necessary, advance or retard the proper adjustment screw(s) until a satisfactory image is obtained over the entire field.

Step 14. Lock the lens in place by tightening the focus set-screw.

## 6-4. CHANGING THE LENS ASSEMBLY (TYPES 299 AND 302)

Cameras that are normally supplied with a f/2.8, 75-mm lens (focal length) may in some instances need to be replaced with a f/1.9, 75-mm lens (focal length). To make this change, proceed as follows:

Step 1. Loosen the *slide lock thumb screw* and slide camera to the extreme forward position.

Step 2. Remove the screw and washer located on the top ridge of the *mounting plate.*

Step 3. Slide the camera and *sliding adapter* completely from the *mounting plate.*

Step. 4. Unscrew the *shutter release cable* by inserting hand into the barrel end of *camera housing* and loosening cable release bushing.

Step 5. Remove the two flat head screws which hold the *mounting plate* to the *camera housing.*

Step 6. Lift the *mounting plate* containing the lens assembly from the *camera housing.*

Step 7. Loosen the two *focus set-screws;* take out entire lens assembly and replace it with the new one.

Step 8. Replace and secure *mounting plate,* washer, screw, and the *shutter release cable.*

Step 9. Refocus the camera as described in paragraph 6-3.

NOTE: The Type 298 lens is not interchangeable because of the difference in design of the mounting plate and the location of the cable release.

## 6-5. DU MONT WARRANTY AND SERVICE NOTICE

All instruments produced by the Technical Products Division of Allen B. Du Mont Laboratories, Inc. are sold under the Du Mont Warranty. For the provisions of this warranty, and the Service policies of the Technical Products Division, see the Warranty and Service Notice on inside of back cover.

## TABLE 6-1.
## TABLE OF REPLACEABLE PARTS

| PART NUMBER | DESCRIPTION |
|---|---|
| 05004440 | Switch, push-button SPST |
| 12004010 | Lamp, screw base (Type 112, 1.2V, 0.220 amp.) |
| 12004040 | Lampholder |
| 29000570 | Battery 1.5V (leakproof) Type C |
| 30015731 | Spring, viewing door catch |
| 30040211 | Spring, dichroic mirror |
| 30040222 | Spring, lens door |
| 35030991 | Battery holder |
| 42010141 | Rubber light shield |
| 45005691 | Data-card glass |
| 48002711 | Dichroic mirror |
| 48002841 | Data-card mirror |
| 48003750 | Shutter release cable |
| 48003011 | Lens assembly f/1.9 |
| 48003771 | Lens assembly f/2.8 |
| 48004971 | Lens assembly f/1.5 |
| 60903231 | Slide-lock thumb screw |

# –NOTES–

# WARRANTY AND SERVICE NOTICE
# for
# Industrial Type Cathode-ray Tubes and Instruments

### DU MONT INSTRUMENTS

Each instrument manufactured by the Technical Products Division of Allen B. Du Mont Laboratories, Inc., is guaranteed to equal or exceed its published performance specifications. It is further guaranteed against defective materials (other than the cathode-ray tube) and workmanship for a period of one year from delivery date. Any defective instrument or an instrument that does not meet or exceed our specifications will, upon inspection by us, be repaired or replaced at our discretion should such defect appear within the guarantee period.

To register this guarantee, the enclosed guarantee card must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

### DU MONT CATHODE-RAY TUBES

Industrial type cathode-ray tubes manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed for 1000 hours of operation or for a six-month period from date of shipment, whichever expires first. Adjustments will be made on the merit of each individual claim because of the widely varying applications to which such tubes are subjected, and a tube which becomes defective during the guarantee period will be replaced ONLY AFTER INSPECTION AT THE FACTORY. Cathode-ray tubes returned under the guarantee, must be shipped with transportation paid.

### BURNED-OUT HEATERS AND BROKEN GLASS ARE NOT COVERED BY THE TUBE GUARANTEE

To register a tube guarantee, the guarantee card enclosed with the tube must be filled out properly and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. TYPE NUMBER AND SERIAL NUMBER OF THE CATHODE-RAY TUBE MUST BE INCLUDED. The serial number of the tube will be found either on the glass stem of the electron-gun structure or on the bulb near the Du Mont brand. Tubes must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

### CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

### SERVICE

In order to insure factory service under our guarantees, the guarantee cards enclosed with all instruments and tubes must be properly filled out and returned. In all cases where service or adjustment is requested, please write first to the factory giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing in this respect, address:

**Allen B. Du Mont Laboratories, Inc.**
*Technical Products Division*
760 Bloomfield Avenue, Clifton, New Jersey

The Technical Products Division will then send to the customer, the written procedure for sending the instrument back to the factory. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

### REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the type number and serial number of the instrument and refer to the component by its symbol designation and description on the circuit schematic. This will help to expedite service.

DUMONT

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